S3500 SATA MLC Enterprise Value SSDs for IBM System x

IBM Redbooks Product Guide

The S3500 SATA 1.8-inch and 2.5-inch MLC Enterprise Value solid-state drives (SSDs) for IBM® System x® employ MLC NAND flash memory and a 6 Gbps SATA interface to provide an affordable solution with industry leading performance. They are targeted at workloads that require high I/O performance in random read operations, including content delivery, streaming video, and big data analytics. The 1.8-inch SSDs can also be used in the IBM eXFlash solution for maximum capacity and performance.

Figure 1 shows the S3500 SATA 2.5-inch MLC Enterprise Value SSD.

Figure 1. S3500 SATA 2.5-inch MLC Enterprise Value SSD

Did you know

Unlike client solid-state drives, S3500 SATA MLC Enterprise Value SSDs are designed to operate 24 hours per day, 7 days per week (24x7), and they are equipped with a robust suite of enterprise features, including SMART attributes, hot-plug support, high reliability, enhanced ruggedness, thermal throttling, and enhanced power loss protection. They also leverage full end-to-end data path protection to protect the integrity of the data that is transferred to and from the NAND flash memory or stored in the memory.

S3500 SATA MLC Enterprise Value SSDs provide outstanding IOPS/watt and cost/IOPS for for read-intensive enterprise applications like web serving, content delivery, streaming video, and big data.

Rigorous testing of S3500 SATA MLC Enterprise Value SSDs by IBM through the IBM ServerProven® program assures a high degree of confidence in storage subsystem compatibility and reliability. Providing an additional peace of mind, these drives are covered under IBM warranty.

Part number information

Table 1 lists the information for ordering part numbers and feature codes.

Table 1. Ordering part numbers and feature codes

Description	Part number	Feature code
1.8-inch SSDs		
S3500 80GB SATA 1.8" MLC Enterprise Value SSD for IBM System x	00AJ040	A4KV
S3500 240GB SATA 1.8" MLC Enterprise Value SSD for IBM System x	00AJ045	A4KW
S3500 400GB SATA 1.8" MLC Enterprise Value SSD for IBM System x	00AJ050	A4KX
2.5-inch SSDs		
S3500 120GB SATA 2.5" MLC HS Enterprise Value SSD for IBM System x	00AJ000	A4KM
S3500 120GB SATA 2.5" MLC SS Enterprise Value SSD for IBM System x	00AJ020	A4KR
S3500 240GB SATA 2.5" MLC HS Enterprise Value SSD for IBM System x	00AJ005	A4KN
S3500 240GB SATA 2.5" MLC SS Enterprise Value SSD for IBM System x	00AJ025	A4KS
S3500 480GB SATA 2.5" MLC HS Enterprise Value SSD for IBM System x	00AJ010	A4KP
S3500 480GB SATA 2.5" MLC SS Enterprise Value SSD for IBM System x	00AJ030	A4KT
S3500 800GB SATA 2.5" MLC HS Enterprise Value SSD for IBM System x	00AJ015	A4KQ
S3500 800GB SATA 2.5" MLC SS Enterprise Value SSD for IBM System x	00AJ035	A4KU

The part numbers include the following items:

- One SSD without a drive tray (1.8-inch SSDs) or one SSD with a hot-swap or simple-swap drive tray (2.5-inch SSDs)
- Support Flyer for SSD
- Warranty Flyer
- *Important Notices* document

Features

The S3500 SATA MLC Enterprise Value SDDs have the following features:

- Industry standard 1.8-inch or 2.5-inch form factors
- Support for standard a 2.5-inch drive bay (2.5-inch SSDs), eXFlash drive bay (1.8-inch SSDs), or SSD drive bay (1.8-inch SSDs) on selected System x, IBM iDataPlex®, IBM BladeCenter®, and IBM Flex System™ servers
- Cost-effective Intel 20 nm MLC NAND flash memory
- SATA MLC solid-state drive with high read performance and consistently low latencies to fulfill client needs in the enterprise space
- High reliability and enhanced ruggedness
- Energy saving, with as little as 5 W power consumption per drive
- Absence of moving parts to reduce potential failure points in the server
- S.M.A.R.T. support
- Advanced Encrypting Standard (AES) 256-bit encryption
- Full end-to-end data path protection
- Thermal throttling to extend the life of the drive
- Enhanced power loss data protection

Enterprise Value SSDs and Enterprise SSDs have similar read IOPS performance, but the key differences between them is their endurance (or life expectancy) and write IOPS performance. SSDs have a huge but finite number of program/erase (P/E) cycles, which affect how long they can perform write operations and thus their life expectancy. Enterprise Value SSDs have a better cost per read IOPS ratio but lower endurance and write IOPS performance compared to Enterprise SSDs. SSD write endurance is typically measured by the number of program/erase cycles that the drive can incur over its lifetime, which is listed as TBW in the device specification.

The TBW value that is assigned to a solid-state device is the total bytes of written data that a drive can be guaranteed to complete. Reaching this limit does not cause the drive to immediately fail; the TBW simply denotes the maximum number of writes that can be guaranteed. A solid-state device does not fail upon reaching the specified TBW, but at some point after surpassing the TBW value (and based on manufacturing variance margins), the drive reaches the end-of-life point, at which time the drive goes into read-only mode. Because of such behavior, careful planning must be done to use SSDs in the application environments to ensure that the TBW of the drive is not exceeded before the required life expectancy.

For example, for the S3500 240GB SATA 2.5-inch MLC Enterprise Value SSD to last in five years inside of the 140 TB of TBW, the drive write workload must be limited to no more than 77 GB of writes per day. For the device to last in three years, the drive write workload must be limited to no more than 128 GB of writes per day.

Technical specifications

Table 2 and Table 3 present technical specifications for the S3500 SATA 1.8-inch and 2.5-inch MLC Enterprise Value solid-state drives respectively.

Table 2. S3500 SATA 1.8-inch MLC Enterprise Value SSD technical specifications

Feature	80 GB	240 GB	400 GB
Part number	00AJ040	00AJ045	00AJ050
Hot-swap drive	Yes§	Yes§	Yes§
Interface	6 Gbps SATA	6 Gbps SATA	6 Gbps SATA
Form factor	1.8-inch	1.8-inch	1.8-inch
Capacity	80 GB	240 GB	400 GB
Endurance	5-year lifetime (45 TB TBW)	5-year lifetime (140 TB TBW)	5-year lifetime (225 TB TBW)
Data reliability	< 1 in 10^{17} bits read	< 1 in 10^{17} bits read	< 1 in 10^{17} bits read
MTBF, hours	2,000,000	2,000,000	2,000,000
IOPS reads*	70,000	75,000	75,000
IOPS writes*	7,000	7,500	11,000
Sequential read rate†	340 MBps	500 MBps	500 MBps
Sequential write rate†	100 MBps	260 MBps	380 MBps
Read latency	50 µs	50 µs	50 µs
Write latency	65 µs	65 µs	65 µs
Shock, operating	1000 *g,* 0.5 ms	1000 *g,* 0.5 ms	1000 *g,* 0.5 ms
Vibration, operating	2.17 *g* rms 5-700 Hz	2.17 *g* rms 5-700 Hz	2.17 *g* rms 5-700 Hz
Vibration, non-operating	3.13 *g* rms 5-800 Hz	3.13 *g* rms 5-800 Hz	3.13 *g* rms 5-800 Hz
Typical power	5 W	5 W	5 W

§ This SSD can be a hot-swap or non-hot-swap drive depending on the server in which it is installed.
* 4 KB block transfers
† 128 KB block transfers

Table 3. S3500 SATA 2.5-inch MLC Enterprise Value SSD technical specifications

Feature	120 GB		240 GB		480 GB		800 GB	
Part number	00AJ000	00AJ020	00AJ005	00AJ025	00AJ010	00AJ030	00AJ015	00AJ035
Hot-swap drive	Yes	No	Yes	No	Yes	No	Yes	No
Form factor	2.5-inch		2.5-inch		2.5-inch		2.5-inch	
Interface	6 Gbps SATA		6 Gbps SATA		6 Gbps SATA		6 Gbps SATA	
Capacity	120 GB		240 GB		480 GB		800 GB	
Endurance	5-year lifetime (70 TB TBW)		5-year lifetime (140 TB TBW)		5-year lifetime (275 TB TBW)		5-year lifetime (450 TB TBW)	
Data reliability	< 1 in 10^{17} bits read		< 1 in 10^{17} bits read		< 1 in 10^{17} bits read		< 1 in 10^{17} bits read	
MTBF, hours	2,000,000		2,000,000		2,000,000		2,000,000	
IOPS reads*	75,000		75,000		75,000		75,000	
IOPS writes*	4,600		7,500		11,000		11,500	
Sequential read rate†	445 MBps		500 MBps		500 MBps		500 MBps	
Sequential write rate†	135 MBps		260 MBps		410 MBps		450 MBps	
Read latency	50 µs		50 µs		50 µs		50 µs	
Write latency	65 µs		65 µs		65 µs		65 µs	
Shock, operating	1000 *g,* 0.5 ms		1000 *g,* 0.5 ms		1000 *g,* 0.5 ms		1000 *g,* 0.5 ms	
Vibration, operating	2.17 *g* rms 5-700 Hz		2.17 *g* rms 5-700 Hz		2.17 *g* rms 5-700 Hz		2.17 *g* rms 5-700 Hz	
Vibration, non-operating	3.13 *g* rms 5-800 Hz		3.13 *g* rms 5-800 Hz		3.13 *g* rms 5-800 Hz		3.13 *g* rms 5-800 Hz	
Typical power	5 W		5 W		5 W		5 W	

* 4 KB block transfers
† 128 KB block transfers

Supported servers

The S3500 SATA MLC Enterprise Value SSDs and supported RAID controllers can be installed in the System x and iDataPlex servers that are listed in Table 4 and the BladeCenter and Flex System servers that are listed in Table 5.

Table 4. Supported System x and iDataPlex servers

Part number	Description	x3100 M4 (2582)	x3250 M4 (2583)	x3300 M4 (7382)	x3500 M4 (7383)	x3530 M4 (7160)	x3550 M4 (7914)	x3630 M4 (7158)	x3650 M4 (7915)	x3690 X5 (7147)	x3750 M4 (8722)	x3850 X5 (7143)	dx360 M4 (7912)
00AJ040	S3500 80GB SATA 1.8" MLC Enterprise Value SSD	N	N	N	N	N	N	N	Y	Y	Y	Y	N
00AJ045	S3500 240GB SATA 1.8" MLC Enterprise Value SSD	N	N	N	N	N	N	N	Y	Y	Y	Y	N
00AJ050	S3500 400GB SATA 1.8" MLC Enterprise Value SSD	N	N	N	N	N	N	N	Y	Y	Y	Y	N
00AJ000	S3500 120GB SATA 2.5" MLC HS Enterprise Value SSD	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N
00AJ020	S3500 120GB SATA 2.5" MLC SS Enterprise Value SSD	N	Y	N	N	Y	N	N	N	N	N	N	Y
00AJ005	S3500 240GB SATA 2.5" MLC HS Enterprise Value SSD	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N
00AJ025	S3500 240GB SATA 2.5" MLC SS Enterprise Value SSD	N	Y	N	N	Y	N	N	N	N	N	N	Y
00AJ010	S3500 480GB SATA 2.5" MLC HS Enterprise Value SSD	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N
00AJ030	S3500 480GB SATA 2.5" MLC SS Enterprise Value SSD	N	Y	N	N	Y	N	N	N	N	N	N	Y
00AJ015	S3500 800GB SATA 2.5" MLC HS Enterprise Value SSD	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N
00AJ035	S3500 800GB SATA 2.5" MLC SS Enterprise Value SSD	N	Y	N	N	Y	N	N	N	N	N	N	Y

Table 5. Supported BladeCenter and Flex System servers

Part number	Description	HS12 (8028)	HS22 (7870)	HS22V (7871)	HS23 (7875)	HS23E (8038)	HX5 (7872)	HX5 (7873)	x220 (7906)	x222 (7916)	x240 (8737)	x440 (7917)
00AJ040	S3500 80GB SATA 1.8" MLC Enterprise Value SSD	N	N	Y	N	N	N	Y	N	N	N	N
00AJ045	S3500 240GB SATA 1.8" MLC Enterprise Value SSD	N	N	Y	N	N	N	Y	N	N	N	N
00AJ050	S3500 400GB SATA 1.8" MLC Enterprise Value SSD	N	N	Y	N	N	N	Y	N	N	N	N
00AJ000	S3500 120GB SATA 2.5" MLC HS Enterprise Value SSD	N	Y	N	Y	Y	N	N	Y	N	Y	Y
00AJ020	S3500 120GB SATA 2.5" MLC SS Enterprise Value SSD	N	N	N	N	N	N	N	N	N	N	N
00AJ005	S3500 240GB SATA 2.5" MLC HS Enterprise Value SSD	N	Y	N	Y	Y	N	N	Y	N	Y	Y
00AJ025	S3500 240GB SATA 2.5" MLC SS Enterprise Value SSD	N	N	N	N	N	N	N	N	N	N	N
00AJ010	S3500 480GB SATA 2.5" MLC HS Enterprise Value SSD	N	Y	N	Y	Y	N	N	Y	N	Y	Y
00AJ030	S3500 480GB SATA 2.5" MLC SS Enterprise Value SSD	N	N	N	N	N	N	N	N	N	N	N
00AJ015	S3500 800GB SATA 2.5" MLC HS Enterprise Value SSD	N	Y	N	Y	Y	N	N	Y	N	Y	Y
00AJ035	S3500 800GB SATA 2.5" MLC SS Enterprise Value SSD	N	N	N	N	N	N	N	N	N	N	N

For the latest compatibility information for System x, BladeCenter, iDataPlex, and Flex System servers, see the IBM ServerProven® website: http://ibm.com/servers/eserver/serverproven/compat/us/

Supported storage controllers

The S3500 SATA MLC Enterprise Value SSDs require a supported disk controller. Tables 6 and 7 list the System x, BladeCenter, and Flex System controllers that support the SSDs that are installed in a supported server.

Table 6. RAID controllers for System x and iDataPlex servers that are supported by internal SSDs

Part number	Product description	x3100 M4 (2582)	x3250 M4 (2583)	x3300 M4 (7382)	x3500 M4 (7383)	x3530 M4 (7160)	x3550 M4 (7914)	x3630 M4 (7158)	x3650 M4 (7915)	x3690 X5 (7147)	x3750 M4 (8722)	x3850 X5 (7143)	dx360 M4 (7912)
Onboard	ServeRAID M5110e SAS/SATA Controller	N	N	N	N	N	N	N	Y	N	Y	N	N
81Y4481	ServeRAID M5110 SAS/SATA Controller	N	N	Y	Y	Y	Y	N	Y	N	Y	N	Y
81Y4448	ServeRAID M1115 SAS/SATA Controller	N	N	Y	Y	Y	Y	N	N	N	Y	N	Y
81Y4492	ServeRAID H1110 SAS/SATA Controller	Y	Y	Y	N	Y	Y	N	N	N	N	N	Y
90Y4304	ServeRAID M5016 SAS/SATA Controller	N	N	N	N	N	N	N	N	Y	N	Y	N
46M0829	ServeRAID M5015 SAS/SATA Controller	Y	Y	N	N	N	N	N	N	Y	N	Y	N
46M0916	ServeRAID M5014 SAS/SATA Controller	Y	Y	N	N	N	N	N	N	Y	N	Y	N
46M0831	ServeRAID M1015 SAS/SATA Controller	Y	Y	N	N	N	N	N	N	N	N	N	N
Onboard	ServeRAID C100 / C105	N	N	N	N	N	N	N	N	N	N	N	N
46M0912	IBM 6Gb Performance Optimized HBA	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y
46C8988	N2115 SAS/SATA HBA	N	N	N	Y	N	N	N	Y	N	Y	Y	N

Table 7. RAID controllers for BladeCenter and Flex System servers that are supported by internal SSDs

Part number	Product description	HS12 (8028)	HS22 (7870)	HS22V (7871)	HS23 (7875)	HS23E (8038)	HX5 (7872)	HX5 (7873)	x220 (7906)	x222 (7916)	x240 (8737)	x440 (7917)
90Y4390	ServeRAID M5115 SAS/SATA Controller	N	N	N	N	N	N	N	Y	N	Y	Y
90Y4750	ServeRAID H1135 Controller	N	N	N	N	Y	N	N	Y	N	N	N
Onboard	ServeRAID C105	N	N	N	N	N	N	N	N	N	N	N
Onboard	Integrated LSI SAS2004	N	N	N	Y	N	N	N	N	N	Y	Y
46C7167	ServeRAID-MR10ie (CIOv) Controller	N	N	N	N	N	N	N	N	N	N	N
Onboard	Integrated LSI SAS1064e	N	Y	Y	N	N	N	N	N	N	N	N
46M6908	SSD Expansion Card for IBM BladeCenter HX5	N	N	N	N	N	N	Y	N	N	N	N

For the latest information about the adapters that are supported by each System x server type, see the IBM ServerProven website: http://ibm.com/servers/eserver/serverproven/compat/us/

Supported operating systems

SSDs operate transparently to users, storage systems, applications, databases, and operating systems. The controllers that support SSDs are supported by the following operating systems:

- Microsoft Windows Server 2012
- Microsoft Windows Server 2008 R2
- Microsoft Windows Server 2008, Datacenter x64 Edition
- Microsoft Windows Server 2008, Datacenter x86 Edition
- Microsoft Windows Server 2008, Enterprise x64 Edition
- Microsoft Windows Server 2008, Enterprise x86 Edition
- Microsoft Windows Server 2008, Standard x64 Edition
- Microsoft Windows Server 2008, Standard x86 Edition
- Microsoft Windows Server 2008, Web x64 Edition
- Microsoft Windows Server 2008, Web x86 Edition
- Microsoft Windows Server 2008 Foundation
- Microsoft Windows Server 2008 HPC Edition
- Microsoft Windows HPC Server 2008
- Microsoft Windows Small Business Server 2008 Premium Edition
- Microsoft Windows Small Business Server 2008 Standard Edition
- Microsoft Windows Essential Business Server 2008 Premium Edition
- Microsoft Windows Essential Business Server 2008 Standard Edition
- Red Hat Enterprise Linux 6 Server Edition
- Red Hat Enterprise Linux 6 Server x64 Edition
- Red Hat Enterprise Linux 5 Server Edition
- Red Hat Enterprise Linux 5 Server Edition with Xen
- Red Hat Enterprise Linux 5 Server with Xen x64 Edition
- Red Hat Enterprise Linux 5 Server x64 Edition
- Red Hat Enterprise Linux 4 AS for AMD64/EM64T
- Red Hat Enterprise Linux 4 AS for x86
- SUSE Linux Enterprise Server 11 for AMD64/EM64T
- SUSE Linux Enterprise Server 11 for x86
- SUSE Linux Enterprise Server 11 with Xen for AMD64/EM64T
- SUSE Linux Enterprise Server 10 for AMD64/EM64T
- SUSE Linux Enterprise Server 10 for x86
- SUSE Linux Enterprise Server 10 with Xen for AMD64/EM64T
- SUSE Linux Enterprise Server 10 with Xen for x86
- VMware vSphere 5.1
- VMware vSphere 5.0
- VMware ESX 4.1
- VMware ESXi 4.1
- VMware ESX 4.0
- VMware ESXi 4.0

For the latest information about the specific supported versions and service packs, see the IBM ServerProven website: http://ibm.com/servers/eserver/serverproven/compat/us/. Click **IBM System x**, then **Storage controllers & SSD adapters**, to see the support matrix. Select the check mark box that is associated with the System x server in question to see the details about operating system support.

Warranty

The S3500 SATA MLC Enterprise Value SSDs carry a one-year, customer-replaceable unit (CRU) limited warranty. When the SSDs are installed in a supported IBM server, these drives assume your system's base warranty and any IBM ServicePac® upgrades.

Physical specifications

The S3500 SATA 1.8-inch MLC Enterprise Value SSDs have the following physical specifications.

Dimensions and weight (approximate):

- Height: 5 mm (0.2 in.)
- Width: 54 mm (2.1 in.)
- Depth: 79 mm (3.1 in.)
- Weight: 49 g (0.1 lb)

Shipping dimensions and weight (approximate):

- Height: 32 mm (1.3 in.)
- Width: 226 mm (8.9 in.)
- Depth: 150 mm (5.9 in.)
- Weight: 399 g (0.9 lb)

The S3500 SATA 2.5-inch MLC Enterprise Value SSDs have the following physical specifications.

Dimensions and weight (approximate):

- Height: 7 mm (0.3 in.)
- Width: 70 mm (2.8 in.)
- Depth: 100 mm (4.0 in.)
- Weight: 70 g (0.15 lb)

Shipping dimensions and weight (approximate):

- Height: 63 mm (2.5 in.)
- Width: 174 mm (6.9 in.)
- Depth: 133 mm (5.2 in.)
- Weight: 434 g (1.0 lb)

Operating environment

The S3500 SATA MLC Enterprise Value SSDs are supported in the following environment:

- Temperature: 0 - 70 °C (32 - 158°F)
- Relative humidity: 8 - 85% (noncondensing)
- Maximum altitude: 3,050 m (10,000 ft)

Agency approvals

The S3500 SATA MLC Enterprise Value SSDs conform to the following regulations:

- UL
- CB
- CE Mark
- C-Tick Mark
- Taiwan (BSMI Certification)
- KCC
- VCCI

Related publications

For more information, see the following documents:

- IBM US Announcement Letter for the S3500 SATA MLC Enterprise Value SSDs
  http://ibm.com/common/ssi/cgi-bin/ssialias?infotype=dd&subtype=ca&&htmlfid=897/ENUS113-137
- IBM Redbooks® ServeRAID Adapter Quick Reference
  http://www.redbooks.ibm.com/abstracts/tips0054.html?Open
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This document was created or updated on August 9, 2013.

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